

Reducing the Risk of Deadly Mixups With Epidural and Intravenous Drugs

Matthew Grissinger, RPh, FASCP



Mr. Grissinger is Director of Error Reporting Programs at the Institute for Safe Medication Practices in Horsham, Pa. (www.ismp.org).

PROBLEM: A number of risks have been associated with epidural injections and infusions. One of the most significant risks involves erroneous infusions of epidural medications—particularly epidural infusions containing bupivacaine (e.g., Marcaine, Hospira)—by the intravenous (IV) route of administration. The administration of IV bupivacaine can quickly lead to cardiotoxicity. A boxed warning for bupivacaine notes that it can cause profound disturbances in cardiac rhythm and contractility that are resistant to typical resuscitation efforts, making these mixups particularly deadly.¹⁻³ Likewise, medications intended for IV administration—particularly morphine and vincristine—have been given via the epidural or intrathecal route, also leading to fatal outcomes.^{4,5}

The Institute for Safe Medication Practices (ISMP) and the National Patient Safety Agency (NPSA) in the United Kingdom (U.K.) have published numerous alerts regarding mixups between epidural and IV medications.¹⁻⁵ Similar to an error that involved a 16-year-old patient in labor who died after receiving IV fentanyl and bupivacaine, the NPSA and British news media reported that another young woman died after receiving IV bupivacaine.²⁻⁶

In this case, the woman in labor should have received normal saline IV, but a nurse accidentally selected a virtually identical bag of bupivacaine located in the same unlocked drawer as the saline. The bupivacaine infusion did not contain fentanyl, so the bag did not need to be locked in storage. Because the nurse thought she was hanging a bag of normal saline, she had no reason to consider asking another nurse to double-check the solution before administering it. The patient

experienced seizures and cardiac arrest that could not be treated successfully.

Unfortunately, these cases are not isolated events. Between 2000 and 2004, three deaths were reported in the U.K. following the IV administration of epidural bupivacaine.² Between 2005 and 2006, another six adverse events were reported in which epidural IV medications were given.² In the U.S., the ISMP learned about three more cases between 2004 and 2007, one fatality and two near-fatalities. In one of the near-fatal cases, the patient received a small IV loading dose of bupivacaine and morphine intended for epidural patient-controlled analgesia (PCA). The ISMP has also published multiple cases in which IV medications, such as vincristine, were accidentally administered by the intrathecal route, again leading to fatalities.⁵

SAFE PRACTICE RECOMMENDATIONS: Unlike many unavoidable threats to patient safety, those involving epidural-IV mixups are well understood and can be prevented by industry changes that would make IV and epidural syringe and tubing connections incompatible with each other. The ISMP and other national and international safety agencies continue to work toward that goal. Until then, the ISMP encourages all staff members to evaluate the risks in their organizations and to implement the recommendations in the checklist that follows.

Although these recommendations cannot prevent every mixup, procedures should be in place to safeguard against the accidental administration of IV drugs by the epidural route and the administration of epidural drugs by the IV route.

Prescribing IV and epidural medications. When appropriate, agents for epidural administration that may be less cardiotoxic than bupivacaine, such as ropivacaine (Naropin, APP Pharmaceuticals) should be considered. Although newer agents might produce less cardiotoxicity than bupivacaine, controversy continues over whether bupivacaine should be re-

placed by the new agents.² The route of administration should be clearly defined on all prescriptions and orders for drugs.

Dispensing IV and epidural medications. Infusions that are not available commercially should be prepared in the pharmacy, or they should be sent to an outside company to be prepared.

Epidural medications should be dispensed to clinical areas in the appropriate container, such as in a properly labeled syringe or a small-volume bag for administration. Bar-code technology should be used to prepare and dispense IV and epidural medications.

A process should be established to ensure delivery of the correct epidural medication to the correct clinical unit. In low-volume-use areas, the epidural agent should be dispensed immediately before it is used, and the drug should be handed to an authorized clinician. In high-volume-use areas (e.g., labor and delivery), the epidural medication should be immediately placed in the appropriate storage location. Epidural drugs should not be left in medication rooms for the clinical staff to put away, and they should not be sent in pneumatic tubes to the units.

Dispensing intrathecal medications. Intrathecal drugs should be dispensed in overwraps that help differentiate these syringes and bags from other drugs intended for IV administration.

Dispensing IV vincristine. This drug should be dispensed in small-volume bags to differentiate them from syringes used for intrathecal medications.

Labeling epidural medications. Infusion bags and syringes that contain epidural medications should be clearly labeled with the words "FOR EPIDURAL USE ONLY" in a large font. Using a color can help to differentiate epidural products from IV medications.

Storage. The risk of mixups can be reduced by storing epidural and IV infusions separately, including medications that are stored with controlled substances.

Selecting pumps and administration sets. For epidural infusions, the staff

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should select pumps that look different from the pumps used for IV infusions. The pumps that are used to deliver epidural medications should be clearly labeled with the words "EPIDURAL ONLY." When possible, smart pump technology should be used to administer epidural and IV medications. The use of dual-channel pumps for simultaneous administration of IV and epidural infusions should be avoided.

Yellow-lined tubing without injection ports for epidural infusions can help to distinguish its appearance from typical IV tubing. The special yellow-lined tubing should never be used for anything other than epidural administration.^{7,8} A neon sticker should be placed on the epidural tubing and should include the word "EPIDURAL." Neon stickers are often included with the yellow-lined tubing.

Placing IV pumps and epidural pumps on opposite sides of the patient's bed can help maintain the separation of the two infusion systems.

A tube or catheter should always be traced from the patient to the point of origin before any new device or infusion is connected and before the infusion rate is adjusted.

The epidural and IV bags in the pumps should always be hung with the labels facing out so that they can be read. Pharmacy labels should be applied to accommodate loading syringes or bags in a pump with the labels facing out.

Administering IV and epidural drugs. An independent double-check is required at the bedside of all individuals receiving epidural medications and IV opioids to verify the patient, pump settings, line attachment, drug, dosage, and concentration. The receiving nurse and the transferring nurse should be required to verify pump settings and line attachments during shift changes and patient transfers.

Bar-code technology should be used during drug administration to verify the patient and product selection.

Monitoring patients. A resuscitation protocol should be established to treat the effects of bupivacaine toxicity wherever this drug is administered. The protocol and required medications should be accessible to the staff on code carts or with other secured emergency supplies. The use of lipid emulsion may also be beneficial in treating bupivacaine toxicity.^{2,9}

Staff education. A credentialing process should be developed to ensure

the competency of all practitioners who are expected to hang epidural infusions and program pumps. The clinical staff should be made aware of the risk for mix-ups between epidural and IV infusions, and all staff members who prescribe, dispense, and care for patients receiving bupivacaine should be educated on how to recognize and manage toxicity using the established resuscitation protocol.

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The reports described in this column were received through the ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP Web site (www.ismp.org) or communicated directly to ISMP by calling 1-800-FAIL-SAFE or via e-mail at ismpinfo@ismp.org. ■